

CURRICULUM VITAE

Richard William Zabel

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Education

B.S. (with honors and distinction), in Botany, The University of Michigan, Ann Arbor, 1983.

M.S., in Plant Biology, The University of Michigan, Ann Arbor, 1988.

Ph.D., in Quantitative Ecology and Resource Management, University of Washington, Seattle, 1994.

Affiliations

Affiliate Associate Professor, University of Washington, School of Aquatic and Fishery Sciences

Affiliate Faculty, University of Idaho, Department of Fish & Wildlife Resources

Research Interests

Population Dynamics and Life Cycle Modeling. Using demographic population viability analyses to assess impacts to populations. Detecting density dependence in natural populations.

Growth and Bioenergetics. Developing models of growth and bioenergetics in response to varying habitat conditions.

Response of populations to climate. Impacts of climate variability and climate change on natural populations.

Migrational Behavior. Models of dispersal patterns in natural populations. Variability of migration-related life history traits among closely-related taxa.

Survival and Selection Processes in Natural Populations. Patterns of population survival and selection related to individually-varying phenotypic traits

Research Experience and Employment

2012 to Present: Division Director, Fish Ecology Division, Northwest Fisheries Science Center.

The Fish Ecology Division has 70 full-time members with 4 Programs – Watershed (Roni), Ocean/Estuary (Fresh), Ecosystem Analysis (Sanderson), and Migrational Behavior (Dey) – and 2 Senior Scientist (Ric Brodeur and Bill Peterson).

2010 to 2012: Program Manager of the Riverine Survival Program, Fish Ecology Division, Northwest Fisheries Science Center, National marine Fisheries Service.

June 2005 to December 2010: Supervisory Mathematical Statistician, Fish Ecology Division, Team Leader of the Quantitative Ecology Team.

September 1999 to June 2005: Mathematical Statistician, Fish Ecology Division, Northwest Fisheries Science Center, National Marine Fisheries Service.

July 1997 to September 1999: Research Consultant, Columbia Basin Research, School of Fisheries, University of Washington.

January 1995 to June 1997: Post Doctoral Research Associate, School of Fisheries, University of Washington. Worked with Professor James Anderson.

March 1994 to December 1994: Research Consultant, Center for Quantitative Science, University of Washington.

September 1988 to February 1994: Research Assistant, Quantitative Ecology and Resource Management Graduate Program, University of Washington.

January 1985 - June 1988: Graduate student and Teaching Assistant, Department of Biology, University of Michigan.

Peer-Reviewed Publications

Zabel, R.W., Brian J. Burke, Mary L. Moser, Christopher C. Caudill. *In press*. Modeling temporal phenomena in variable environments with parametric models: An application to migrating salmon. *Ecological Modeling*.

Hegg, J. C., B. P. Kennedy, P. M. Chittaro, and R. W. Zabel. 2013. Spatial structuring of an evolving life-history strategy under altered environmental conditions. *Oecologia* 172:1017–1029.

Chittaro, P. M., R. W. Zabel, W. Palsson, and C. Grandin. 2013. Population interconnectivity and implications for recovery of a species of concern, the Pacific hake of Georgia Basin. *Marine Biology* 160: 1157-1170.

Sandford, B.P., R.W. Zabel, L.G. Gilbreath, and S.G. Smith. 2012. Exploring latent mortality of juvenile salmonids related to migration through the Columbia River hydropower system. *Trans. Amer. Fish. Soc.* 141:2, 343-352.

Zabel, R.W., P.S. Levin, N. Tolimieri, and N.J. Mantua. 2011. Interactions between climate and population density in the episodic recruitment of bocaccio, a Pacific rockfish. *Fisheries and Oceanography* 20:4, 294–304.

Crozier, L.G., M. D. Scheuerell, and R.W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift toward Earlier Migration Date in Sockeye Salmon. *American Naturalist* 178: 755-773.

Zabel, R.W., K. Haught, P. Chittaro. 2010. Variability in fish length/otolith radius relationships among populations of Chinook salmon. *Environmental Biology of Fish*. *Environmental Biology of Fish* 89:267-278.

Crozier, L.G., R.W. Zabel, E. Hockersmith, and S. Achord. 2010. Interacting effects of density and temperature on body size in multiple populations of Chinook salmon. *Journal of Animal Ecology* 79: 342–349.

Scheuerell, M.D., R.W. Zabel, and B.P. Sandford. 2009. Relating juvenile migration timing and survival to adulthood in two species of threatened Pacific salmon (*Oncorhynchus spp.*). *Journal of Applied Ecology* 46: 983-990.

Gurarie, E., J.J. Anderson, and R.W. Zabel. 2009. Continuous models of population-level heterogeneity inform analysis of animal dispersal and migration. *Ecology* 90: 2233-2242.

Zabel, R.W., J. Faulkner, S.G. Smith, J.J. Anderson, C. Van Holmes, N. Beer, S. Iltis, J. Krinke, G. Fredricks, B. Bellerud, J. Sweet, A. Giorgi. 2008. Comprehensive Passage (COMPASS) Model: a model of downstream migration and survival of juvenile salmonids through a hydropower

- system. *Hydrobiologia* 609: 289-300.
- Zabel, R. W., B. J. Burke, M. L. Moser, C. A. Peery. 2008. Relating dam passage time of adult salmon to varying river conditions using time-to-event analysis. *American Fisheries Society Symposium* 61: 153-163.
- Waples, R.S., R.W. Zabel, M.D. Scheuerell, and B.L. Sanderson. 2008. Evolutionary responses by Pacific salmon to ecological changes associated with the Columbia River hydropower system. *Molecular Ecology* 17, 84–96.
- Crozier, L.G., R.W. Zabel, A.F. Hamlet. 2008. Predicting differential effects of climate change at the population level with life-cycle models of spring Chinook salmon. *Global Change Biology* 14, 236–249.
- Ferguson, J., G. Ploskey, K. Leonardsson, R.W. Zabel, and H. Lundqvist. 2008. Combining turbine blade strike and life cycle models to rapidly assess mitigation strategies for fish passing dams. *Canadian Journal of Fisheries and Aquatic Sciences* 65: 1568-1585.
- Williams, J. G., R. W. Zabel, R. S. Waples, J. A. Hutchings and W. P. Connor. 2008. Potential for anthropogenic disturbances to influence evolutionary change in the life history of a threatened salmonid. *Evolutionary Applications* 1: 271–285.
- Achord, S., R. W. Zabel, B. Sandford, and J. G. Williams. 2007. Migration timing and estimated parr-to-smolt survival rates of wild Snake River spring/summer Chinook salmon smolts from Idaho at Lower Granite Dam. *Trans. Amer. Fish. Soc.* 136: 142-154.
- Caudill C. C. W. R. Daigle, M. L. Keefer, C. T. Boggs, M. A. Jepson, B. J. Burke, R. W. Zabel, T. C. Bjornn, and C. A. Peery. 2007. Slow dam passage in Columbia River salmonids associated with unsuccessful migration: delayed negative effects of passage obstacles or condition-dependent mortality? *Canadian Journal of Fisheries and Aquatic Sciences* 64: 979-995.
- Zabel, R. W., M. D. Scheuerell, M. M. McClure, and J. G. Williams. 2006. The interplay between climate variability and density dependence in the population viability of Chinook salmon. *Conservation Biology* 20(1):190-200.
- Crozier, L. G., R. W. Zabel. 2006. Climate impacts at multiple scales: Evidence for differential population responses in juvenile Chinook salmon. *Journal of Animal Ecology* 75: 1100-1109.
- C. A. Morgan, C. A., A. De Robertis, R. W. Zabel. 2005. Columbia River plume fronts: I Hydrography, zooplankton distribution, and community composition. *Marine Ecology Progress Series* 299: 19-31.
- De Robertis, A., C. A. Morgan, R. A. Schabetsberger, R. W. Zabel, R. D. Brodeur, R. L. Emmett, C. M. Knight, G. Krutzikowsky, E. Casillas. 2005. Columbia River plume fronts: II Distribution, abundance and feeding ecology of juvenile salmon. *Marine Ecology Progress Series* 299: 33-44.
- Zabel, R.W., T. Wagner, J. L. Congleton, S. G. Smith, and J. G. Williams. 2005. Survival and selection of migrating salmon from capture-recapture models with individual traits. *Ecological Applications* 15: 1427-1439.
- Anderson, J. J., E. Gurarie, and R. W. Zabel. 2005. Mean free-path length theory of predator-prey interactions: application to juvenile salmon migration. *Ecological Modeling* 186: 196-211.
- Moser, M. L., R. W. Zabel, B. J. Burke, and L. C. Stuehrenberg. 2005. Factors affecting adult Pacific lamprey passage rates at hydropower dams: using “time to event” analysis of radiotelemetry data. Pages 61-70 In M. T. Spedicato, G. Marmulla, and G. Lembo (eds.) *Aquatic Telemetry: advances and applications*. FAO-COISPA, Rome.
- M. D. Scheuerell, P. S. Levin, R. W. Zabel, J. G. Williams, and B. L. Sanderson. 2005. A new

- perspective on the importance of marine-derived nutrients to threatened stocks of Pacific salmon (*Oncorhynchus* spp.). Canadian Journal of Fisheries and Aquatic Sciences 62: 961-964.
- Zabel, R. W., and S. Achord. 2004. Relating size of individuals to juvenile survival within and among closely-related populations of chinook salmon. Ecology 85: 795-806.
- Zabel, R. W., C. J. Harvey, S. L. Katz, T. P. Good, and P. S. Levin. 2003. Ecologically sustainable yield. American Scientist 91: 150-157.
- Achord, S., P. S. Levin, and R. W. Zabel. 2003. Density-dependent mortality in Pacific salmon: the ghost of impacts past? Ecology Letters 6: 335-342.
- S.G. Smith, S.G., W.D. Muir, E.E. Hockersmith, R.W. Zabel, R.J. Graves, C.V. Ross, W.P. Connor, and B.D. Arnsberg. 2003. Influence of river conditions on survival and travel time of Snake River fall chinook salmon. North American Journal of Fisheries Management 23: 939-961.
- Zabel, R. W. 2002. Using “travel-time” data to characterize the behavior of migrating animals. American Naturalist 4:372-387.
- Zabel, R. W., and P. S. Levin. 2002. Simple assumptions on age composition lead to erroneous conclusions on the nature of density dependence in age-structured populations. Oecologia 133: 349-355.
- Zabel, R. W., and J. G. Williams. 2002. Selective mortality in chinook salmon: what is the role of human disturbance? Ecological Applications 12: 173-183.
- Levin, P. S., S. Achord, B. E. Feist, and R. W. Zabel. 2002. Non-indigenous brook trout and the demise of Pacific salmon: a forgotten threat? Proceedings of the Royal Society of London (B) 269: 1663-1670.
- Levin, P. S., R. W. Zabel, and J. G. Williams. 2001. The road to extinction is paved with good intentions: negative association of fish hatcheries with threatened salmon. Proceedings of the Royal Society of London (B) 268: 1153-1158.
- Zabel, R. W., and J. G. Williams. 2000. Comments on “Contrasting patterns of productivity and survival rates for stream-type chinook salmon (*Oncorhynchus tshawytscha*) populations of the Snake and Columbia rivers” by Schaller et al. (1999). Canadian Journal of Fisheries and Aquatic Sciences 57: 1739-1741.
- Zabel, R.W., J.J. Anderson, and P.A. Shaw. 1998. A multiple reach model describing the migratory behavior of Snake River yearling chinook salmon (*Oncorhynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 55: 658-667.
- Zabel, R.W., and J.J. Anderson. 1997. A model of the travel time of migrating juvenile salmon, with an application to Snake River spring chinook salmon. North American Journal of Fisheries Management, 17: 93-100.

Selected Technical Reports and Dissertation

- Williams, J. G., S. G. Smith, R. W. Zabel, W. D. Muir, M. D. Scheuerell, B. P. Sandford, D. M. Marsh, R. A. McNatt, S. Achord. 2005. Effects of the Federal Columbia River Power System on Salmonid Populations. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-63, 150 p.
- Zabel, R. W., S. G. Smith, W. D. Muir, D. M. Marsh, J. G. Williams, and J. R. Skalski. 2002. Survival estimates for the passage of spring-migrating juvenile salmonids through Snake and Columbia River dams and reservoirs, 2001. Report to Bonneville Power Administration, Contract DE-AI79-93BP10891.

- Zabel, R. W., S. G. Smith, W. D. Muir, D. M. Marsh, J. G. Williams, and J. R. Skalski. 2001. Survival estimates for the passage of Spring-Migrating Juvenile Salmonids through Snake and Columbia River dams and reservoirs, 2000. Report to Bonneville Power Administration, Contract DE-AI79-93BP10891. (Available from Northwest Fisheries Science Center, 2725 Montlake Blvd. E., Seattle, WA 98112-2097.).
- Zabel, R. W. 1994. Spatial and Temporal Models of Migrating Juvenile Salmon with Applications. Ph.D. dissertation, University of Washington, Seattle.

Teaching experience

- 2011. Guest Lecturer at the University of Washington, QSCI 597, Graduate Seminar.
 - 2009. Guest Lecturer at the University of Washington, QSCI 597, Graduate Seminar.
 - 2008. Guest Lecturer at the University of Washington, CEE 576, Water Resources.
 - 2007. Guest Lecturer at the University of Washington, Tacoma, Salmon Biology.
 - 2004. Guest Lecturer at the University of Washington, QSCI 597, Graduate Seminar.
 - 1994 and 1995: Lecturer, University of Washington. Taught Statistical Inference in Applied Research.
- January 1985 to June 1988: Teaching Assistant, University of Michigan. Taught the following courses: Introductory Biology, Writing for Biologists, Plant Systematics, Biology of World Hunger, Plant Biology, General Ecology, and Genetics.

Advising/Mentoring

- Master's Thesis Committee: Erica Alston, Clark University, Atlanta (graduated 2004).
- National Research Council (NRC) Postdoctoral adviser for Lisa Crozier (2004-2007).
- Oak Ridge Institute for Science and Education Mentor for Kerri Haught (2005-2006).
- Ph. D. Supervisory Committee: Eli Gurarie (graduated 2008), University of Washington.
- Master's Supervisory Committee: Kara Cromwell (graduated 2009), University of Idaho
- Master's Supervisory Committee: Jessica Beetz (graduated 2009), University of Washington
- Master's Supervisory Committee: Jens Hegg (2009 - 2011), University of Idaho
- Ph.D. Supervisory Committee: Jens Hegg (2011 - Present), University of Idaho
- Ph.D. Supervisory Committee: Jeff Rutter (2012 – Present), University of Washington
- Post Doctoral Advisor: Jennifer Gosselin (2012 – Present)
- Master's Supervisory Committee: Mark Sorel (2013), University of Washington

Talks delivered at Annual Meetings (National or International)

- American Fisheries Society (2011)
- Advances in the Population Ecology of Stream Salmonids (2010)
- International Otolith Symposium (2009).
- Fisheries and the Environment (2007).
- European Inland Fisheries Advisory Commission (2006).
- American Society of Limnology and Oceanography, 2005 (Invited speaker).
- Western Society of Naturalists, 2004, 2005 (Invited Symposium Speaker).
- Society for Conservation Biology, 2001.

International Fish Biology Congress, 2000, 2002.
Biometrical Society, Western North American Region, 1999 (Invited speaker).
Ecological Society of America, 1993, 1995, and 2004 (presider).
Resource Modeling Association, 1990 and 1998.

Honors, Fellowships, Awards

Department of Commerce, group Gold Medal Award, 2010
Supervisor of the Year, Northwest Fisheries Science Center, 2010.
Mellon Foundation Fellowship to attend the Naturalist-Ecologist Training Program, University of Michigan Biological Station, 1985.
Honors Concentration Program, 1983, University of Michigan.
College Honors Program, 1979-1981, University of Michigan.

Service

Editorial Board: Conservation Letters (2012-)
Guest Subject Matter Editor: Ecological Applications (2007-2008).
Reviewer for the following peer-reviewed journals: Science, Nature Climate Change, Proceedings of the National Academy of Science, Proceedings of the Royal Society of London *B*, Ecology, Conservation Letters, Ecological Applications, Ecology Letters, Journal of Applied Ecology, Journal of Animal Ecology, Frontiers in Ecology and the Environment, Oikos, Canadian Journal of Fisheries and Aquatic Sciences, Transactions of the American Fisheries Society, North American Journal of Fisheries Management, Fisheries, American Fisheries Society Symposium, Journal of Experimental Marine Biology and Ecology, Environmental Modeling and Software, Hydrobiologia, Evolutionary Applications, Oecologia, Journal of Environmental Management, Journal of Fish Biology, Environmental Biology of Fish, Global Change Biology, Ecology of Freshwater Fish
Review panel for EPA, Science for Sustainable and Health Tribes (2013)
Udall Foundation: Guest Expert for Udall Scholar Orientation, Tucson, AZ (2012, 2013).
Review panel for USGS for proposals to study natal origins of rainbow trout in the Grand Canyon (2011).
Review panel for the Northwest Fisheries Science Center Internal Grants program (2007-2010).
Reviewer for the Millennium Ecosystem Assessment (2004).
Scientific Review Committee (SRC) for the Cooperative Monitoring and Research Committee, established by the Washington State Board of Natural Resources (2004).
Reviewed reports and proposals for: NSF, CALFED, Bonneville Power Administration, Chelan County PUD, ODFW, NOAA Northwest Regional Office, University of Washington, CAMEO, California Delta Science Program
Oversight Committee: Acoustic tag design and development team, Chelan County PUD